



The East Bay Children's Respiratory Health Study Traffic-Related Air Pollution Near Busy Roads

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Air Resources Board

California Environmental Protection Agency

Thank you Ms. Witherspoon and good morning Chairman Lloyd and members of the Board. Today's health update will discuss a study by the Office of Environmental Health Hazard Assessment titled "The East Bay Children's Respiratory Health Study: Traffic-related Air Pollution near Busy Roads." This study was designed to explore the associations between respiratory symptoms and exposures to traffic-related air pollutants among children living and attending schools near busy roads. The children in the study were economically disadvantaged and may be more susceptible to adverse health impacts from air pollution exposure.

Background

- ◆ **Association between traffic and respiratory disease**
 - mostly European Studies
- ◆ **Ambient monitors**
 - typically do not measure direct impact of traffic
- ◆ **Surrogate measures of traffic pollution**
 - residential proximity, traffic volume
- ◆ **Question of extrapolation to U.S.**
 - traffic mix, emission controls, population may differ
- ◆ **Need to evaluate health impacts of proximity to traffic in California**



There is a growing body of literature that links traffic air pollution exposure to respiratory health in children. These studies have been done mostly in the Netherlands and the United Kingdom. Most of these studies have used ambient monitors, which typically do not directly measure impacts of traffic, or have used surrogates of exposure to traffic such as residential proximity and traffic volume. Very few have measured direct emitted traffic pollutants such as black carbon, nitric oxide, carbon monoxide, and particulate matter. In addition, it is unknown how well these studies can be extrapolated to the U.S. population since vehicle and population factors may differ. Therefore, there is a need to develop and test accurate measures of traffic and its associations to respiratory health in California.

Methods

- ◆ **Cross-sectional study in Alameda County**
 - 1,109 students between 3rd - 5th grades
- ◆ **School selection criteria - (10 schools)**
 - distance from major roads and highways
 - similar demographics across schools
- ◆ **Surveyed child and parent**
 - history, home environment, and demographics
- ◆ **Air pollutants measured at the schools**
 - PM₁₀, PM_{2.5}, NO_x, NO₂, NO, and black carbon
- ◆ **Moderate regional air pollution levels**

This study was conducted as a school-based, cross-sectional study in Alameda County in 2001, and recruited a total of 1,109 students between 3rd and 5th grades. The study area was comprised of ten neighborhoods. School sites were selected to represent a range of locations upwind and downwind from major roads. In addition, schools were selected to have similar demographic characteristics (such as race/ethnicity and indicators of socioeconomic status) so that the effects of traffic exposures would not be masked (or confounded) by these factors. The investigators obtained information on bronchitis symptoms and asthma, demographics, home environmental factors, and activity factors using parental questionnaires in English and Spanish. This study measured concentrations of traffic pollutants at schools including PM₁₀, PM_{2.5}, total nitrogen oxides (or NO_x), nitrogen dioxide, nitric oxide, and black carbon. The investigators assumed that traffic-related pollutants measured at the neighborhood schools would be a good proxy for the children's overall exposure to these pollutants. This study was done in a region with relatively moderate regional pollution levels which made it possible to look at the impacts of pollution related to nearby traffic.

Population

♦ Race/Ethnicity

- White 13 %
- Black 11 %
- Hispanic 44 %
- Asian 14 %
- Other 19 %

♦ SES indicators

- Household at/below Federal poverty level of 31%
- Parent's education: high school or less equaled 49%



The study population was ethnically diverse. In addition, the study population was of lower socioeconomic status which may contribute to their susceptibility to pollutant effects due to lack of access to health care, poor housing characteristics, and poor nutrition. Thirty-one per cent of households reported household income below the federal poverty line and 49 percent of the parent's had a high school education or less. This map illustrates the study area and the location of the schools in relation to major roads with the traffic counts for both car and truck traffic.

Results

- ◆ Schools downwind and near major roadways had higher concentrations of black carbon, NO_x, and NO
- ◆ Found a 5 to 8% increase in asthma and bronchitis symptoms with exposure to these traffic-related pollutants
- ◆ Suggest that fresh traffic emissions may play a role in these relationships
- ◆ ARB supporting a new study to improve exposure estimates for the East Bay Children's Study

Brett C. Singer, et al. "Passive measurement of nitrogen oxides to assess traffic-related pollutant exposure for the East Bay Children's Respiratory Health Study," *Atmospheric Environment* 38 (2004) 393–403

Kim, et al. "Traffic-related Air Pollution near Busy Roads, The East Bay Children's respiratory Health Study," *American Journal of Respiratory and Critical Care Medicine*, Vol. 170, 2004.

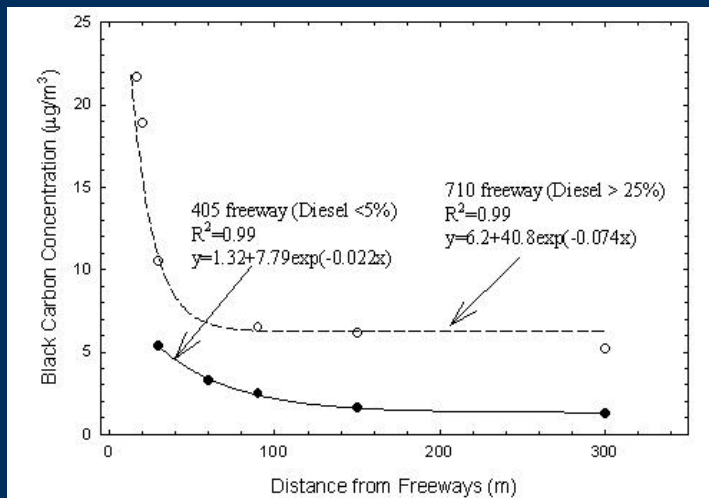
The bay area has strong prevailing winds, and this study found that downwind direction and proximity to major roads was an important determinant of increased exposure to traffic pollutants. This study found higher concentrations of black carbon, NO_x, and NO at schools located downwind from freeways as compared with those schools upwind or further from major traffic sources.

For children residing at their current address for at least 1 year, investigators found a modest but significant increase of 5 to 8% in bronchitis symptoms and asthma symptoms in children in neighborhoods with higher concentrations of traffic pollutants.

The higher effect estimates found with black carbon, NO_x, and NO suggest that fresh traffic emissions may play a role in the increased respiratory symptoms seen in the study. Although these pollutants may serve as indicators of exposure to traffic related pollutant mixtures, they may also act as causal agents themselves. The concentrations of NO_x, NO, and black carbon were highly correlated. However, the relative effects of diesel truck traffic vs. total vehicular traffic could not be studied.

ARB is supporting a new analysis of the East Bay Study data to improve exposure estimates and better characterize the associations between respiratory health and traffic pollutant exposure. Measurement of personal exposures to traffic pollutants is not feasible in large population-based studies, therefore, the new study funded by the ARB will use a combination of geographic modeling approaches together with ambient monitoring data of NO_x and NO₂ within the neighborhoods to estimate children's total exposures, including both school and residential exposures.

Black Carbon Decreases with Distance from Highway



Zhu, et al., "Study of ultrafine particles near a major highway with heavy-duty diesel traffic," *Atmospheric Environment*, 36, (2002) 4323-4335

The findings from the East Bay Children's Study agree with results from other California exposure studies, including the ARB funded study from the Southern California Particle Center and Supersite. The graph demonstrates that the very high levels of black carbon next to freeways in Los Angeles drop rapidly to background levels within 150 meters for both the 405 freeway with less than 5% trucks and the 710 freeway with more than 25% trucks.

Implications

- ◆ Findings are consistent with previous investigations in Europe
- ◆ Helped support passage of a School Siting Bill by Senator Escutia (SB 352)
 - 500 foot setbacks from freeways improve children's health
- ◆ Supports need for additional measures that reduce emissions and exposures to traffic air pollution in order to improve children's health

The findings from this study are consistent with previous investigations in Europe.

The results of this study helped support the passage of a School Siting Bill authored by Senator Martha Escutia in 2003. This bill amends the education code to ensure that new school sites are prohibited within 500 feet from the edge of the closest traffic lane of a freeway or other busy traffic corridors. This bill acknowledges that setbacks from freeways are beneficial for children's health.

In addition, the results from the East Bay Children's Respiratory Health Study support the need for additional measures that reduce emissions and exposures to traffic air pollution in order to improve children's health.



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This concludes my presentation. I will be happy to answer any questions.